AGRICULTURAL NEWS LETTER

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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigators at agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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It Takes All Sizes

U.S. farm experts who visited Soviet Russia have pointed out that an important problem of that country's inefficient collectivized agriculture is the excessive size of many operating units. Collective and state farms are often so large and unwieldy that it is not possible to properly operate them from one central point.

The question of proper farm size for effective operation is not unknown to American agriculture. Here, however, the problem has been somewhat different, in that many units are too small to support the investment in modern facilities required to meet today's production standards and competition. Fortunately, the free-enterprise economy of the U.S. is in the process of making the necessary adjustment as evidenced by the constant rise in the average farm size for a number of years.

This dynamic nature of the free economy would suggest that a productive unit (whether it produces farm crops or heavy machinery) will tend to reach the size which corresponds to the job it must do. That this is so, is evident from the vast array of farms and businesses of every size that make up the productive capacity of the United States.

Among the factors which determine the size of a business or farm establishment are the tools needed for efficient operation, the size of the investment required, and the extent of the market for the end product. None of these factors is arbitrarily set by the producer. They result from economic conditions.

Only a large firm, for example, would be in the position to manufacture automobiles, industrial chemicals, or large electric appliances to meet the demands of the U.S. market. Each of these products could be made on a small scale—as Henry Ford once made an automobile—but the cost of such a product would be beyond the mass market. By the same token, the investment needed in wheat farming is such that a small farm could hardly survive the competition. Raising or manufacturing many specialty items is, on the other hand, well done on a small scale.

A survey of the nation's largest firms shows clearly the intimate relationship between size and function. The 25 largest industrial firms are engaged in only five major fields of activity. Of these, ten are in the production of oil, which requires vast investments in both real estate and plants. Steel and other primary metals producers are next with eight firms. Four make automobiles and another four are engaged in making electrical and business machines. Two, including Du Pont, are in chemicals.

That a similar distribution exists in agriculture is evident from USDA statistics showing that the average investment per farm is highest among cash grain farms in the corn belt, about $97,000; sheep ranches in the northern plains run about $84,000; whereas cotton farms of the Southern Piedmont average to only $17,000. Whatever the field of economic activity, the size of the operating unit must correspond to the job it has to do.

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KETOSIS AND ITS TREATMENT . . .

By L. J. MUNZENMAIER, JR., M.S.
Industrial and Biochemicals Department
E. I. du Pont de Nemours & Co. (Inc.)

Ketosis, or acetonemia, is a complex metabolic disorder of high-producing milking cows, due to nutritional stresses following calving. It usually occurs from a few days to a few weeks after calving. The disorder results from an excessive demand of the mammary gland on a limited supply of carbohydrate forerunners, or precursors. It causes an estimated $10 million annual loss in U. S. milk production.

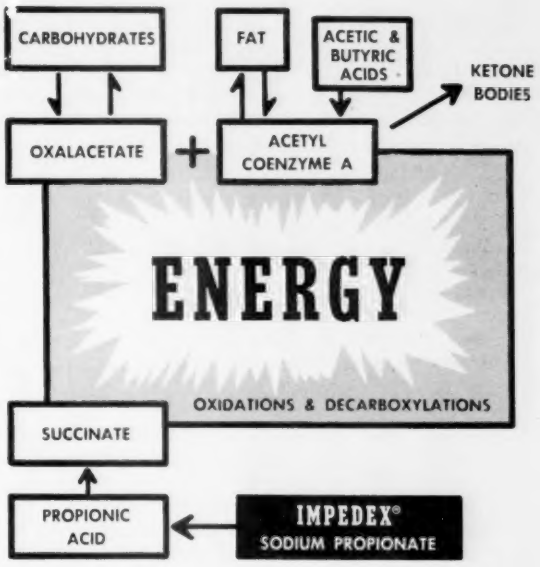
Like other ruminant animals (and unlike nonruminants), the cow does not directly benefit from carbohydrates in its diet, which ferment to acetic, propionic, and butyric acids in her rumen. Only propionic acid is a true carbohydrate precursor; the other two acids which tend to aggravate ketosis are normally capable of yielding fat and energy.

Ketosis is precipitated by a disturbance of the energy cycle or supply system (See Figure) in the animal's tissues due to increased competition between the mammary gland and other tissues for the carbohydrate precursors following calving. A key metabolite, oxalacetate, sparks the cycle. It condenses with acetyl coenzyme A, and following a series of oxidations and decarboxylations, eventually reforms into oxalacetate. Each transformation releases energy to the animal. Acetic and butyric acid enter the cycle as acetyl coenzyme A, while propionic acid enters between this coenzyme and oxalacetate. Propionic acid is a precursor for oxalacetate, as well as a necessary ingredient for carbohydrate synthesis.

Competition for Carbohydrates

When the mammary gland must produce large amounts of lactose, it draws excessively on the cow's supply of carbohydrate precursors, propionic acid and oxalacetate, in competition with body needs. When oxalacetate is inadequate, reserve body fats are called in for energy, entering the cycle as acetyl coenzyme A. They cannot, however, be efficiently oxidized without oxalacetate and the result is excessive ketone-body formation. Milk production goes down and the cow's health deteriorates.

Ketosis can be treated by intravenous injection of glucose which will provide more oxalacetate and help restore balance to the animal's energy system. The most direct and economical method of eliminating the ketotic condition is, however, by feeding a supplement containing "Impedex" sodium propionate N.F. This provides the animal with the metabolite in short supply, restoring an adequate supply of oxalacetate and nutritional balance for proper milk production.



SIMPLIFIED KREB'S energy cycle shows metabolic processes through which the cow obtains energy. When competition for carbohydrate precursors during lactation brings on ketosis, administration of "Impedex" sodium propionate provides needed metabolite.

DU PONT PROVIDES SCHOLARSHIPS, PRIZES FOR 4-H PROJECTS

Six $400 college scholarships, trips to Chicago, and a number of gold medals are being provided this year by the Du Pont Company to recognize outstanding achievement in 4-H beef projects. The scholarships will go to national winners in the finals at the 4-H Club Congress in Chicago the week after Thanksgiving. State winners will earn the expense-paid trip to the Congress; county winners are to be awarded medals.

An estimated 136,000 members will be enrolled in the beef program, learning about breeds, balanced rations, and marketing. They are also taught to fit, show, and judge animals. This is the third, and by far the largest, farm youth program in which Du Pont is participating. For several years, the Company has been a donor to the Future Farmers' Foundation and the National 4-H Foundation.

Can U. S. Science Meet The Soviet Threat?

By CRAWFORD H. GREENEWALT*
President
E. I. du Pont de Nemours & Co. (Inc.)

In a free society, all branches of science move forward together on an unbroken front. There has been no great advance that was not a cooperative fusion of many branches of knowledge. Surely this is inherently a more productive system than one in which the direction of inquiry is subject to violent change dictated not by scientific but by political objectives.

It is proper to admit that our science also undergoes shifts of emphasis as interest swings from one discipline to another. In a free and dynamic environment, such changes are not only natural but healthy. For there are fashions in science, as there are fashions in thought and in dress. The interests of our young people will change due sometimes to progress and exciting discovery, sometimes to the demands of national security, often simply to chance. But in the main, science as a great compendium of human knowledge has marched along, with each of its disciplines attracting dedicated followers in sufficient numbers to insure its place in the sun. The Soviet state is producing an extraordinary number of people trained in scientific work. The figures make one wonder if any other professions are practiced and whether science is ready for the onslaught of such masses.

True, we shall need more and better scientists if we are to hold our place in a scientific world. A greatly accelerated program would increase our pool of scientific manpower, but I doubt that a program based on forced and unnatural persuasion would be worth the effort and risk.

If our society is to survive, the choice of a career must be free of artificial stimulus and coercion. We cannot make a scientist by attempting to convert a potential musician, historian, or business executive. For a society without its quota of poets and philosophers will gain no glory by increasing its complement of scientists. As it becomes less free, the strength deriving from free instructions will already be waning. Much as we may admire Soviet achievements, in the long run, the honors for daring and imaginative concepts must rest where men are free and failure carries no threat of personal disaster. The free society alone is hospitable to venture.

Under authoritarian rule, individuals are loathe to get out on a limb, and bureaucratic administration often demands advance proof before authorizing unorthodox approaches. If American science had been thus fettered, it is unlikely much would have been accomplished, for bold endeavors are highly sensitive to the atmosphere in which they are undertaken. Where government funds are concerned, the subsidizing of hunches comes hard. Yet it is risk-taking, based on faith and optimism, which has brought American science to its present state. It has been the entrepreneur as often as the investor who has financed progress.

The question is whether or not we have allowed barriers to arise which restrict our traditional freedom of choice and the incentives which drive us to extraordinary endeavors, and whether the Soviets, having learned their lesson, may not in fact be drifting toward traditional American concepts. Observers of the Russian scene report the adoption of rewards or incentives throughout industry and education.

In the early years, when collective achievement was the order of the day, performance declined. It became necessary to contrive a series of personal inducements—titles, decorations, and public accolades. These have been superseded by the capitalistic emphasis which Marx and Engels deplored. It is reported that a Russian professor of high rank is paid the equivalent of $30,000 a year and is given excellent housing accommodations, use of an automobile, a summer home, and numerous other fringe benefits. This is about equivalent to my own compensation after federal income taxes. There seems to be irony in the fact that the United States, a free nation, taxes individual rewards at rates reaching 91 per cent, whereas in totalitarian Russia, dedicated to the happy notion "from everyone according to his abilities to everyone according to his needs," the maximum rate is 13 per cent.

To win in the international sweepstakes we must keep our traditional incentives bright and glowing. We must recognize the fact that the greater the array of incentives the more men will strive, and that for the average person rewards or recognition of high accomplishment in any of its many forms will bring out the ultimate in creativity and drive.

We have proved that a free society with incentives and rewards geared to personal accomplishment will produce a nation with a strength second to none. The Russians give signs of having learned that lesson. Whatever form our economic warfare with Russia may take, we can win only if we return to those principles. If we do not, the battle before us will be difficult, the outcome uncertain and the price, in human terms, an unconscionable burden upon the future.

* *Excerpts from an address on the occasion of the award to Mr. Greenewalt of the Gold Medal of the American Institute of Chemists for "outstanding leadership in the chemical industry".*

thiram fungicide for

Fungus Control in Peaches and Strawberries

Two important new commercial applications of thiram fungicide have confirmed earlier research findings and preliminary tests. After several years of field trials and residue studies, "Thylate" thiram fungicide was registered this year for control of fruit rots and scab in peach orchards, and also for control of gray mold or botrytis rot in strawberries.

Thiram fungicide was first offered commercially in 1956 for control of apple scab and rust —following 11 years of field trials in Connecticut and other states. During the period of 1955 to 1958, trials were also undertaken with peaches. Experience in 11 states provided the basis for commercial registration.

The fruit phase of peach brown rot was present in eight states, and Rhizopus rot occurred in conjunction with brown rot in three test areas. Most of the evaluations of fruit rot control involved severe conditions in which fruit was held for extended periods after harvest, usually at room temperature, prior to scoring for rot development.

Highest Level of Control

In one New York test, for example, after five days' room temperature storage under humid conditions, fruit from plots sprayed with thiram had only 33 per cent rot, compared with twice as much on fruit sprayed with another organic fungicide, and 86 per cent on fruit treated with wettable sulfur. In South Carolina, treatment resulted in the highest percentage of healthy fruit of the 11 fungicide programs tested. A Maryland report showed that "Thylate" gave excellent control of brown rot on a highly susceptible variety in a season when heavy rains preceded harvest.

For scab control, peaches in a North Carolina test showed a scab index of six (on a 0-100 scale) compared with 74 in untreated plots. In South Carolina, treated plots had no scab-infected fruits, compared with over 45 per cent on untreated plots and up to 15 per cent in plots treated with less effective fungicides. In Mississippi, treated plots showed scab index ratings of 4.8 to 6.0, compared with the index of 31.8 on the untreated check.

Application on Strawberries

Use of "Thylate" on strawberries has resulted in bigger yields and better market quality, since the botrytis rot organism infects berries before picking, it causes losses in the field, and quick spoilage after harvest. Field trials in the nation's major commercial strawberry areas indicate that this fungicide can provide up to twice the pre-harvest control obtained with any other fungicide. All berries, even late pickings, held up exceptionally well after harvest when the fungicide was used, and on first pickings it has given over three times better control of gray mold than any other fungicide tested.

Methods of Application

For strawberries, three to five applications at 10-day intervals are recommended, beginning at the early blossom stage. Good coverage of buds, blossoms, and developing fruit is recommended for best results. Berries treated within three days of picking must be washed to remove residues.

For spray application, "Thylate" thiram fungicide is mixed at rates of two to two and one-half pounds of material in 100 gallons of water, and the mixture is applied at rates up to 200 gallons per acre.

For dust application, a prepared dust should be used—containing seven and one-half to 10 per cent "Thylate" in a suitable diluent such as talc or pyrophyllite. This dust mixture should be applied at the rate of 40 pounds per acre.

DU PONT LAUNCHES FARM RADIO SERIES

On September 7, the Du Pont Company launched its first farm program over seven Florida radio stations. Entitled "Du Pont Farm Market and Weather Round-up," the new broadcast series will supply Florida growers with accurate, current market information, plus a weather forecast for the following day and weather indication for the next few days.

Responsibility for compiling the programs will be in the hands of the local stations. Material will be compiled from all available sources, including county agents, extension specialists, the USDA Crop Reporting Service, weather services, press services, dealers and wholesalers.

The Du Pont program is particularly suited to the Florida area because of the wide fluctuations in weather conditions during relatively short periods of time and the rapid change in plant pest environment that may occur in that climate. The aim of the program is to help growers in protecting their crops and, once produced, in selling them in a favorable market.

POLYETHYLENE Pipe ON THE FARM

Use of properly engineered resin is essential to manufacture of durable polyethylene pipe for agricultural use since failure of pipe on the farm is frequently the result of small variations in the molecular structure of the base resin used in molding pipe. This was revealed in a long-range Du Pont test program, as well as in comparable checks by pipe manufacturers.

The tests used over 600 pipe samples and included the simulation of field conditions. Burst-strength measurements were made at high and low temperatures and at pressures up to three times the normal rate. Both instantaneous and in-use burst tests were conducted. In the instantaneous test, rising pressure is applied inside a pipe section until failure is reached. This provides only a preliminary evaluation since failure in prolonged use always comes at a lower pressure than the instantaneous rating.

In the use tests, high constant pressure and temperature are maintained for a year or more, until failure occurs. Pipe pressure rating is based on the tests, including, of course, a reasonable safety factor.

Another test series reflects the variety of conditions encountered by pipe in use: Changing weather or temperature and pressure surges characteristic of power equipment. These have a decided effect on polyethylene characteristics. For example, strength increases with lower temperature: At 50°F, polyethylene is one-third stronger, and at 60°, it is 20 per cent stronger than at 73°. At 90° (which it may reach in summer sun), the safe working pressure is 80 per cent of its rating, as determined at 73°.

Some of these problems may be avoided by proper installation and maintenance. Heat variations, for one, can be reduced by underground installation. Nevertheless, farm-used flexible pipe is subject to continuously changing conditions and pressures. Thus, the uniform molecular structure of the resin is vital to long-term durability. Cost studies show that this and other safety factors can be included in polyethylene resins at an additional cost of only a few cents per foot. This is a minor consideration since polyethylene will cost approximately $1.10 per foot, compared to a range of $1.25 to $2.75 for rubber, galvanized iron, or other metal pipe.

Also affecting polyethylene strength is use of reclaimed resin, which makes it almost impossible to regulate pipe quality, and may, incidentally, impart an unpleasant taste or noxious materials to drinking water. The National Sanitation Foundation seal on pipe indicates, among other quality factors, that no scrap is used.

Another guide is the imprint "CS-197-59," indicating a pipe complies with the quality standards of the U.S. Department of Commerce. Resistance to the deteriorating effects of sunlight depends on the proper use of carbon black. The quantity, particle size, and dispersion of carbon black must be carefully controlled in resin manufacture. Du Pont supplies a special triangular green tag to firms which use "Alathon" Super 25 resin to indicate that their pipe is made of high-quality basic material.

The development of durable polyethylene has gone a long way toward encouraging use of flexible pipe for permanent farm water systems. Two-thirds of the job of drawing and carrying water can be eliminated with flexible pipe. This is a substantial labor saving, since the requirement for this job runs to 773 hours annually on the average farm.

productivity is the key to KEEPING PRICES DOWN

The careful city housewife who shakes her head at the price of steak or strawberries will be surprised to learn that it would cost another $300 annually to feed her family of four if farmers were still using 1940 practices to raise the nation's food supply. The fact is, of course, that technological advances and other improvements in the productive process have made it possible to produce goods, both agricultural and industrial, at a relatively lower cost to the consumer. Investment in machinery and use of chemicals have made farms more efficient.

An interesting measure of the effect of improved production is contained in a recent Du Pont survey of what some of the company's products would have to cost today if they were still being made by the productive practices of earlier years.

Used in Millions of Homes

Cellophane, now used to package thousands of food and other products, sells for about 59 cents a pound. If made by the process used when the first U.S. plant was erected in 1924, the cost would be $5.50, limiting its use to packing a handful of luxury goods, such as expensive perfumes.*

"Freon" refrigerant and propellant is used as the cooling agent in millions of freezers, refrigerators, and air conditioners, as well as the propelling agent that gives aerosol containers their "push." If made by the old batch method, it would now sell for $1.75 per pound, whereas the current continuous process makes the price to manufacturers only 25 cents per pound.

Same Effect on Farm Prices

The price of dozens of important products—including hose, clothes, shirts, tires, rope—would be considerably higher if the manufacture of nylon had not been improved to reduce the price per pound to an average of $2.00. If made by the methods of 1940, when Du Pont first introduced nylon, the sales price would be about $6.00.

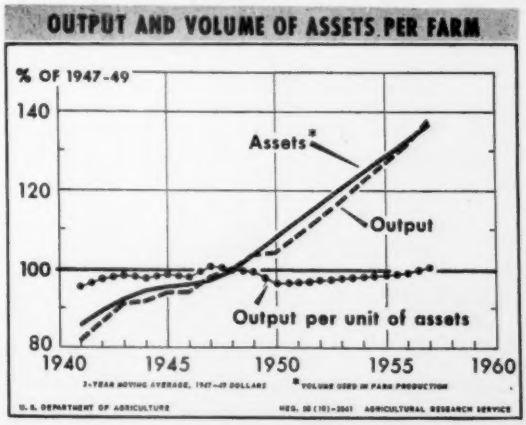
Studies of the input factors now required to raise crops and animals indicate why a similar price situation would exist had technological improvements not been made. For example, the man-hours needed to produce a bale of cotton have declined from some 220 to 90 in the past 20 years.§ Such a decline is true of most other major crops.

Research has also made it possible to grow animals with less feed. It took 7.3 pounds of feed to produce a dozen eggs 30 years ago, but the average now is 5.8. It takes less than half the 5 pounds of feed needed to produce a pound of broiler today. Pork takes 3.1 pounds of feed per pound of animal, but the requirement was 3.9 about 30 years ago.†

Food for 23 People

The advances made can, perhaps, be best summarized in the report from the Agriculture Department that one farm worker today produces enough food and fiber to take care of his needs and of 23 other people. As recently as 1954, the ratio was one to 18. If we go back a century, the ratio was only one to five.

In one way, this ratio is a measure of the nation's living standard. The long-range cost of human labor is higher than the cost of the technological advances required to multiply the productivity of human labor. The ability of U.S. farms and factories to substitute machines and other factors for human labor has been responsible for today's relatively low economic cost of the vast volume of goods produced.



DEPENDENCE OF OUTPUT on the volume of assets used in farm production is shown by USDA graph. The output per unit of assets used has remained fairly constant, so higher output results from an increase in volume of assets used in farm production.

* *The home handyman interested in doing it himself could produce a kind of cellophane in the kitchen sink. He might, however, have trouble selling it at the $50 price per pound needed to cover his costs.*

§ *Benson, Ezra Taft, from a speech before the International Cotton Advisory Committee, Washington, May, 14, 1959.*

† *Swanson, Gordon I.: "Time for Clear Thinking About Agricultural Education, "The Visitor, Vol. XLVI: No. 2, April, 1959, University of Minnesota.*

Experiment Station Demonstration of

APPLICATION OF BRUSH KILLER BY AIR

Chemical control of brush with farm sprayers or truck-mounted equipment has become a widely accepted practice throughout the United States. The efficiency of chemical control has held down the cost of maintaining rural electric and telephone lines. Chemical herbicides have also become an important aid in keeping waterways freer for irrigation or drainage. There are, however, many areas where it is difficult or impossible to get ordinary spray equipment.

The need for a practical method for chemical brush control in inaccessible areas has led to experimentation with airplane application and development of special formulations for this purpose. Airplanes have become a common piece of farm equipment for crop dusting and fertilizer application, but there have been some problems to overcome in using them for herbicides. For example, it is difficult to place sprays of conventional herbicides exclusively over areas to be treated, without hazard to cropland — often at considerable distance from the treated area. And water or other liquid needed for suspension and distribution of chemicals results in a relatively small payload.

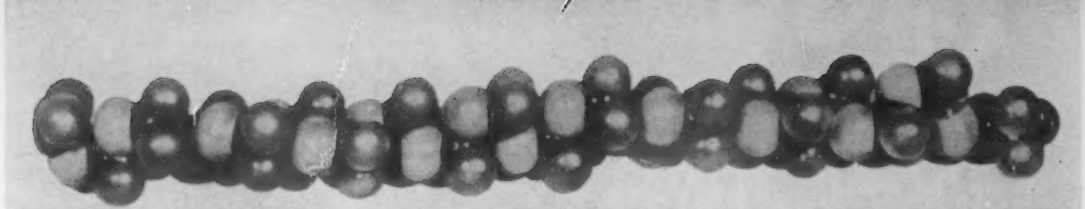
In its continuing program of development and research with the substituted urea herbicides, Du Pont has developed a pelleted formulation of fenuron which makes aerial application possible with safety and at relatively low cost. The material is non-volatile. Since the pellets are applied dry, the area of application can be more accurately controlled, and aircraft can carry a much larger payload. The need for precision application of chemicals has generated much interest in use of helicopters because of their ability to fly slow speeds, and low altitudes.

HELICOPTER makes low-level pass over a drainage ditch at the University of Delaware Agricultural Experiment Station to distribute pellets of "Dybar" fenuron weed and brush killer.

Pictures accompanying this article show application of the pelleted "Dybar" fenuron weed and brush killer, at a University of Delaware field day at Georgetown, this past August.

EQUIPMENT attached to helicopter for application of pellets is easy to load and permits controlled flow rate, with little risk of drainage to croplands.

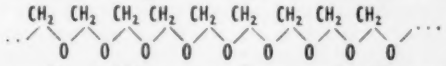
APPLICATION of "Dybar" by air is explained at University of Delaware Farm Field Day Georgetown, Del., by Dr. Carroll M. Voss, of Agrotors, Inc.



NEW PLASTIC FOR AGRICULTURAL EQUIPMENT

The rapid increase in the types of agricultural chemicals has multiplied the corrosion problem for farm equipment. The common metals, such as cast iron, aluminum, brass, even stainless steel, are susceptible to attack by some farm chemicals. Du Pont now produces a new plastic material—"Delrin" acetal resin—which has resistance to chemicals, as well as the physical strength for use in place of die-cast metals.

"Delrin," a linear thermoplastic obtained by controlled polymerization of formaldehyde, is composed of repeated CH_2O groups characterized by an O-CH_2-O linkage (see sketch). It is



the result of 100 years of research: Formaldehyde was discovered by A. M. Butlerov in 1859. He found it would polymerize under certain conditions, that is, its molecules would join in long chains and solidify. The polymer was unstable and difficult to study. Polymer chemistry remained obscure until the work of Hermann Staudinger in the 1920's. Commercial possibilities were indicated when Du Pont investigators discovered polymers with high molecular weight and thermal stability.

Du Pont's work during the past 11 years led to a stable polymer with a wide range of applications. The Company committed over 300 man-years of research to this project and cooperated in three years of field tests with over 250 companies. The investment required to bring "Delrin" from the laboratory to a commercial product was greater than that which led to Du Pont's discovery of nylon 20 years ago.

To test the effect of agricultural chemicals on "Delrin," over a dozen products were chosen as representative of chemicals in widespread use. Aqueous solutions at room temperature were used since the chemicals are normally at ambient temperatures when applied. Tensile test bars were completely immersed. Weight and length measurements were taken periodically and the tensile properties were measured at the end of 12 months. As parts in actual service are only periodically in contact with the chemicals, the test was much more severe than actual service.

None of the chemicals caused a weight loss in the samples and only one showed even minor surface cracking. More importantly, with but one exception, dimensions changed .5 per cent or less. Most samples showed no greater changes than from immersion in water.

DU PONT SCIENTIST checks samples of "Delrin" acetal resin, newly developed plastic, after 12-month submersion in agricultural chemicals to determine its suitability for use in farm equipment.

BOOK ON "MAN AND HIS WORK" IS AVAILABLE FREE

In less than two centuries, the American system has created a social and economic climate in which the workman has been lifted to a high level of personal dignity, responsibility, and individuality. Instead of reducing farm and industrial workers to the status of automatons, industrialization has brought a new and more personal meaning to their work.

This is brought out in a 32-page illustrated booklet, *The Story of Man and His Work*. Published by the Du Pont Company, the new booklet points out that the development of the large scale industrial organization, together with the application of technology to farming and other economic activity, has been the major creative force for the worker's progress.

Du Pont has also published a similar booklet describing the size and nature of the U.S. mass market. Entitled, *The Story of Competition in the American Market*, it shows how competition has increased parallel with the growth of companies like Du Pont.

A copy of either publication may be obtained without cost from: Editor, *Agricultural News Letter*, Du Pont Company, Wilmington 98, Del.

new PRODUCTS AND APPLICATIONS

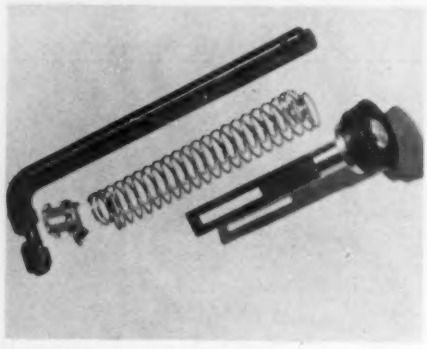
Tests of "Stren" monofilament spinning line show superior knot strength over conventional nylon of the same diameter. Strength in all line depends on the type of knot used and care exercised in the tying. Best performance in the tests resulted with improved clinch and blood knots and with strength as high as 100 per cent of unknotted line. By contrast, the wind overhand knot gave under 50 per cent. With the fish caught, the fisherman will find a fish scaler of "Zytel" nylon resin an easy way of cleaning his catch. It fits any standard quarter-inch electric drill (sold by Jaco Sales Corp., Cleveland, Ohio).

* * * *

Farm and ranch operators using neoprene-coated nylon irrigation dams report them easier to use, more efficient, and more economical than conventional canvas. Nylon dams are easy to set and carry because they weigh only about half as much as dry canvas. The nylon dam absorbs essentially no water, mud does not adhere to the neoprene coating, and the dam remains flexible following long use. These dams are less likely to be cut with a shovel while setting them in a ditch. Nylon is stronger, does not rot or mildew in the ditch or in storage, and can outwear several canvas dams. ("Ditch-Master" nylon dams are made by Colorado Tent & Awning Co., Denver.)

* * * *

Corrosion of sporting firearms can be virtually eliminated through a new procedure for between-season gun storage, without the mess of heavy grease and periodic re-oiling. The method involves a polyethylene storage bag and rust inhibitor discs after conventional oil and solvent cleanup. The container of Du Pont "Alathon" polyethylene resin not only seals firearms in a column of moisture-free air, but permits inspection without unwrapping. The rust inhibitor discs release a chemical vapor to protect the gun. ("No-Wrap" rust inhibitor disc and bag are made by Carl Lampert Company, Milwaukee 12, Wis.)



* * * *

U-cups of "Viton" synthetic rubber on the piston of carburetor accelerating pumps provide smoother driving, more reliable operation, and lower maintenance costs in truck operations. "Viton," a fluorine-based elastomer, maintains its shape and its strength in the presence of fuels, as well as heat. Conventional rubbers are subject to shrinking, allowing leakage around the piston, or to gasoline permeation which swells the rubber and may jam the pump. (U-cups manufactured of Du Pont "Viton" synthetic rubber are used by Holley Carburetor Company, Detroit, Michigan.)

Developmental quantities of a new film with outstanding weathering characteristics, strength, and resistance to chemicals are being produced by Du Pont. Early laboratory samples of unsupported "Teslar" PVF film have not become brittle or discolored after 10 years' exposure in Florida. The film appears promising for agricultural glazing, including greenhouses, cold frames, and poultry house windows, as well as inflatable structures and other outdoor applications. Laminations tested also give indication that building surfaced with "Teslar" should remain serviceable and maintenance-free many times longer than with conventional finishes.

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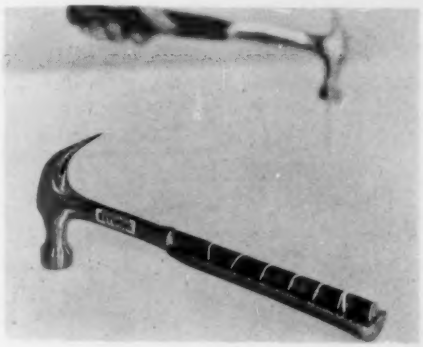

Of interest to the farm handyman is a new hammer with a cushioned grip and internal reinforcement with nylon cord. Developed after a study of nylon cord performance in tires, the grip is of soft vinyl plastic molded around the one-piece hammer's steel handle. Laboratory and field tests conducted by the manufacturer show that the nylon-reinforced plastic handle will outlast the life of the hammer head and will not loosen from the shank in use. The nylon cord is made by the Du Pont Company. ("Evergrip" tools are manufactured by Eastwing Manufacturing Co., Rockford, Ill.)

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Shoes with "welded-on" neoprene soles and specially treated leather uppers will resist barnyard acids, chemical sprays and dips, slush, mud, and moisture. The vulcanizing process used to attach soles eliminates the use of stitching, nails, or filler used in conventional shoes. Uppers are treated with Du Pont's "Quilon" chrome complex that gives the leather water and chemical resistance, while helping keep leather soft even after repeated wetting. A safety feature is a steel box toe and a heavy steel shank under the arch. (RICO "Vulcan-izer" safety shoes are marketed by Record Industrial Co., Philadelphia.)

* * * *

Clogging of roof gutters on farm buildings by twigs and leaves or snow and ice is eliminated by a lightweight plastic guard—a tube-like section, split down one side, which forms a tunnel. Unlike designs which depend on wire mesh to sift out leaves, the new guard sheds air-borne litter in the same way as a peaked roof. It arches above the gutter edges to provide a natural slope. Water enters the gutter through ports formed by scalloped edges around the tube's open side. Made of "Alathon" polyethylene resin, the guard is rustproof, easily flexed and can be cut with a pocket knife. (Made by JO-LI-ET Gutter Guard Corporation, Glenbrook, Conn.)

* * * *

An unusual new type of one-coat paint is ideal for application over rough or porous surfaces, such as cement or cinder block masonry and concrete. The paint is thixotropic, that is, it comes in semi-paste consistency that needs no stirring and is virtually impossible to drip or spatter. Although jelly-like in the can thixotropic paint thins out to easily-spread fluid under brush or roller. The paint is engineered chemically so water vapor passes through, minimizing flaking, peeling, and color changes. It dries in one hour and brushes wash out with soap and warm water. One-coat basement wall paint is sold at all stores handling Du Pont paints.

for an inexhaustible source of energy...

FOCUS ON THE SUN

By FRANK E. EDLIN
Engineering Department
E. I. du Pont de Nemours & Co. (Inc.)

That carefree, medium-sized star of ours isn't going to get off practically scot-free much longer. Scientists and engineers are trapping tiny but infinitely abundant photons of energy from the sun to produce fresh water, heat and cool homes, generate electricity, develop fantastic temperatures for research and to keep our artificial moons talking.

In Florida, for example, the sun's energy distills pure drinking water from the ocean, using solar stills, made essentially of Du Pont plastic materials. In communities all over the world where the local water is not pleasant, residents often buy bottled drinking water at 35 cents for five-gallons, that is $70 per 1,000 gallons. Solar stills should be able to turn out sweet water for very much less. Some residents in dry areas are already using portable stills for drinking water.

Fossil Fuels Limited

Awareness of future energy requirements and emergence of new materials have intensified solar research. The fossil fuels, coal and oil, are limited. Atomic fission is developing, but at relatively high cost. In an even earlier stage of development is the fusion reaction, by which it is hoped power can be released at a controlled rate from the fusion of heavy hydrogen atoms. The sun, meanwhile, remains as a great untapped resource. It delivers more energy every hour than the population uses in a year. It is free and replenished daily; we cannot use it up.

Success depends on materials to capture the sun's rays and the business desire to develop necessary equipment. Total energy is immense, but is worth collecting only with materials that are long-lasting, easily assembled, and low in cost. For the first time, such materials are available. In the Florida stills, for example, ten Du Pont products are used: Troughs of black plastic that hold sea water are covered with clear film. The water evaporates, condenses on the canopy of "Mylar" polyester film and is collected in gutters at the side. It is expected about 300 gallons of fresh water a day will be produced by a 40 by 60 foot still. Du Pont supplied materials and designs to the U. S. Department of the Interior, which is directing the tests. Battelle Memorial Institute directed construction and is collecting data.

Better materials have also stimulated experimentation with home heating. In one method, sunlight passes through clear film and heats a blackened surface. Water or air is heated within the collector and piped to room heaters.

More Energy Available

Another type, a heat pump, operates like a refrigerator in reverse and uses "Freon" refrigerant. It extracts heat from the storage tank when its temperature falls below 110°F.

More solar energy falls on the average house than its occupants can use. A 1,200-square-foot house can be kept at 75°F. with about five gallons of fuel oil a day when the outside temperature average 35°. In most parts of the U.S., enough solar energy to produce that heat strikes a roof 15 by 20 feet.

The sun's rays can also be converted to electricity by solar cells. Still expensive for large applications, they are employed where little energy is needed: Flashlights, radios, clocks, doors, signs, navigation lights, and remote radio transmitters. The solar battery in the Vanguard satellite has helped transmit data continuously since March 1958. Another way to convert sunlight to electricity is to produce steam for a turbine-generator and electrical power will probably be generated by solar energy in the forseeable future.

Photochemical Energy

There are also exciting possibilities in the unexplored areas of photochemistry and photochemical energy. Photochemistry aims to convert simple chemicals into more complex and valuable ones. This is accomplished in a series of intermediate steps, each pushed uphill, energy-wise, by the absorption of a photon of light. As little a plant as the one-celled alga has been doing it since time began. The problems of photochemistry are as basic as those of life and growth, but the rewards could be truly great. The goal is to find a chemical system that will absorb energy from sunlight, then yield it on command in the form of heat or electricity. Several such reactions are known, but none is efficient enough to be practical.

We are only on the threshold of a broader use of solar energy. Hopefully, better designs, still better materials and new knowledge will whittle present costs to a practical level. Meanwhile, we already have the basic materials with which to put solar energy to work in important areas.

less drudgery means

More Education for Work Force

Revival of prewar movies on television has given the present generation a better perspective on the changed status of the average farmer—and, incidentally, the industrial worker as well. In the movies of the 1930's, the farmer was frequently pictured as the country bumpkin and the factory worker as the uncouth fellow with floppy cap and blue collar. Exaggerated as the movie presentation may have been, it is a fact that modern productive methods have brought about tremendous changes in the skill and educational level of what Victorian novelists delighted in calling "the horny-handed sons of toil." Neither the average farmer nor the worker of today bears any resemblance to these stylized movie characters.

One of the basic factors in the change is the decline in the number of unskilled workers, defined as "laborers" by the Census Bureau. Now, almost every job in the production of goods requires a degree of skill. Certainly, today's farm worker must often be both skilled and versed in the newest practices to be successful.

The trend is shown in the labor force figures. At the turn of the century, about half the agricultural work force was classified as "farm laborers." By 1940, the ratio of laborers to "farmers" was 1 to 1.4. Today, the laborer constitutes about one-third of the agricultural work force.

A parallel change has taken place off the farm. Starting with about half the work force unskilled, the present non-agricultural labor force is less than 20 per cent unskilled. The Du Pont Company, with some $30,000 invested per employee, has shown a drop of 50 per cent in the proportion of unskilled workers since 1933, to the low level of about 10 per cent of its employees. Within the past decade, the proportion of skilled operators and mechanics in Du Pont plants has risen from about 55 per cent of the total to nearly 80 per cent.

The educational level of the work force has also risen sharply. In 1957, the median educational attainment of farm laborers and foremen was 8.2 years, while that of the other laborer categories was 8.5 years. The Census Bureau report for 1948 showed the figures to be 7.8 and 8.0, respectively. It is interesting to note that during this period there was no improvement in the case of clerical, sales, and kindred "white collar" workers, the median remaining at 12.4. Since 1940, the median scholastic attainment of the U.S. rural farm population increased by more than one school year, from 7.7 to 8.9. Among Du Pont employees, 90 per cent have high school education, as compared to less than 50 per cent a quarter century ago.

Since the wealth of a country must be measured not only by its volume of material goods, but equally by the skill of its people, the upgrading of the work force is one of this nation's most valuable and irreplaceable assets. With the rapid growth of the population and the increasing competition for world markets, the future growth of the skill level will be a major factor in the economic strength and survival of this country.

FOOTSORE FARMER of another era typifies the drudgery required in the process of meeting the nation's needs for goods, as do workers in Du Pont plant of 1880's. Introduction of modern machinery has not only eliminated physical labor, but has raised the level of skill and education of both the agricultural and the industrial work force, increasing the nation's economic power.

ALFALFA WITH HYBRID VIGOR

An alfalfa breeding method being tried is called the doublecross. It involves four parents and resembles hybrid corn production methods. As with corn, the best combinations of four parents (doublecross) have not been as good as the best combinations of two parents (singlecross). But with corn, doublecross seed has been largely used because of the higher costs of singlecross seed. With alfalfa, however, seed yields from selected parents have been good. Thus, the singlecross is also being used experimentally. With it, seed would be produced by specialized growers, much as corn hybrid seed is produced. But unlike corn, where the parents are propagated by seed, the parents of an alfalfa singlecross are propagated vegetatively. Rooted stem cuttings, made by cutting up alfalfa stems much as we slip geraniums, are transplated by machinery in isolated fields resembling vineyards. Because alfalfa is a long-lived perennial, fields should persist for a long time. After the first year, seed production could be as high as from row seedings, because plants increase in size with age. As with corn, the farmer would buy seed for each planting to get the benefit of the first-generation cross. He could not harvest seed from his fields and retain the initial hybrid vigor. — AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF NEBRASKA.

ZINEB FOR CONTROL OF LEAF SPOT OF BULBOUS IRIS

In 1958 spraying tests in western Washington, the most effective control of *Didymellina* leaf spot of bulbous iris was obtained with zineb and bordeaux mixture. Climatic conditions were favorable for fungus growth and by June, almost every leaf was infected with one or more spots. By the end of June most leaves were dead. However, leaves sprayed with "Parzate"* zineb fungicide and, to a lesser extent, with bordeaux mixture stayed alive much longer than others. On June 13, leaves sprayed with "Parzate" or bordeaux had significantly less diseased area than those treated with other fungicides. The yield of round and large round bulbs was significantly higher in the plots sprayed with "Parzate." For satisfactory control, the fungicides must be used with other standard precautions, particularly proper rotation and sanitation.—EXPERIMENT STATION, STATE COLLEGE OF WASHINGTON.

* *Du Pont trademark.*

ROPE ON THE FARM

The development of synthetic fibers—such as nylon, "Dacron"* polyester fiber and "Orlon"* acrylic fiber—has made possible the production of rope with special characteristics for unusual requirements. Synthetic fiber rope made from nylon or "Dacron" is stronger than manila rope. It is especially useful under wet conditions because the fibers do not absorb water and are not damaged by rot or mildew. Such rope is best adapted for use as towlines, starter ropes, and lariats. Nylon resists damage by petroleum oils, solvents, and alkalies, but can be damaged by acids, paints, and linseed oil. "Dacron" rope is highly resistant to acids, heat, and insect damage—USDA

* *Du Pont trademark.*

JUNE PLANTINGS OF POLYETHYLENE-WRAPPED STRAWBERRY PLANTS

Packed in polyethylene-lined crates and held at 30°F., strawberry plants can now be successfully stored from 8 to 10 months, allowing growers to fit plantings more easily into their production scheme. This reduces cost of weed control because of the shorter time plants are in the field and distributes the work load so that strawberry planting comes after the early spring rush. Best of all, polyethylene-packed strawberry plants set in June produce abundant crops of big, lush berries. Plants come out of storage with green turgid leaves and bright succulent roots. Their field survival is high, and so is their yield.—USDA

MANEB CONTROLS CUCUMBER ANTHRACNOSE

Twelve fungicides were tested to find materials and methods to check cucumber anthracnose, *Colletotrichum lagenarium*. Anthracnose developed severely in the experimental plots and most of the materials, including the coppers, were ineffective. Maneb* was highly effective under severe conditions. Only scattered lesions developed on plants in the spray plots. Although spray applications were best, good protection was obtained with maneb dust. Dusted plants continued to produce throughout the harvest period although some anthracnose spread from nearby untreated plants. Maneb is recommended to Arkansas growers for field control of anthracnose. — AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF ARKANSAS.

* *Du Pont manufactures "Manzate" maneb fungicide.*

NEW FUNGICIDES FOR CONTROL OF LATE BLIGHT

Late blight was severe on both potatoes and tomatoes in the fall of 1958, and this made it possible to evaluate a variety of fungicides on the basis of their ability to control the disease on both crops at various locations in Ohio.

"Manzate" maneb fungicide gave the highest average yield of potatoes in three experiments in widely separated localities. It gave the best control of defoliation due to early, and more particularly late blight, and was definitely superior in the control of late-blight tuber rot.

Late blight infection was more common on the fruit than on the foliage of tomato, where it caused serious fruit loss in many fields, including several in which fungicide spray experiments were being conducted. In an average of four experiments in the vicinity of Wooster, maneb gave the best average control of the disease complex, which included early and late-blight fruit rots, anthracnose fruit rot, and defoliation from all causes. In the same averages, maneb was lowest in percentage of cull fruits, early-blight fruit rot, and in dead foliage. Thus, it seems apparent that maneb is the best of the present-day fungicides for the control of late-blight of potato and tomato, and that it may be expected to give good control of the diseases of tomato. Zineb probably ranks somewhat below maneb in the control of late blight on potato and tomato and in the control of tomato anthracnose, especially in a ten-day schedule of spray application. The fixed coppers, including copper zinc chromate, are effective in the control of late blight on both crops but fail in the control of tomato anthracnose.—OHIO AGRICULTURAL EXPERIMENT STATION.

FERTILIZER INCREASES YIELD OF SEEDCOTTON

Fertilizer significantly increased cotton yields at six locations tested. Nitrogen alone increased yields in four of five tests. Phosphorus at 60 pounds per acre increased yields significantly in one test. This experiment was designed to determine response to varying rates and combinations of phosphate and potash only. The soil tested medium in phosphorus. Phosphorus and potassium, in combination with nitrogen, gave higher yields than nitrogen alone in five tests. Highest yields occurred where nitrogen was applied at 60 pounds per acre on coarse and medium textured soils. Greatest degree of earliness, as indicated by yield at first picking, generally resulted from the fertilizer treatments that produced highest total yields. Applications of 90 to 120 pounds of nitrogen tended to delay maturity and increase vegetative growth on medium and coarse textured soils.—AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF ARKANSAS.

RESTORATION OF DEPLETED SOIL

The Morrow Plots at the University of Illinois laid out in 1876 and the oldest experimental plots in America, demonstrate three important soil management practices: Soil depletion, soil maintenance, and soil improvement. One area had grown corn continuously for 80 years without soil treatment, and soil tilth was poor. These questions were raised: Had soil been permanently damaged? Could it be revived with treatment? Had the best plots reached maximum productivity? To answer these questions limestone was applied in 1955 to previously unlimed plots, at five tons an acre. Nitrogen, as urea, was added along with super-phosphate and muriate of potash. Additional soil treatments were applied the second year. In just two years, heavy fertilizer treatments boosted the yield from 29 to 113 bushels an acre.

The corn yields (bushels per acre) of 1958 emphasize the importance of fertilization:

Fertilizer treatments		Continuous	Rotation	Corn-oats-clover
1904-1955	1955-1958	Corn	Corn-oats	
None	None	32	(No corn yields,	63
	LNPK (new)	130	since 1958 was	146
MLP	ML	84	the oat year in	140
	LNPK (new)	139	this rotation.)	144

L = Lime; N = Nitrogen; P = Phosphorus; K = Potassium; M = Manure.
(New) = New treatment started in 1955 on the old plots.

The lessons from these plots not only give hope of bringing depleted land back into profitable production, but also issue a warning of what can happen to land that is not properly managed.

EXTRA TON OF POTATOES PER ACRE

Potato yields were increased by 35 to 40 bushels (21.4 to 24.2 c.w.t.) per acre where "Manzate"* maneb fungicide was used in Long Island, New Jersey, and Maine, according to grower experience compiled by Du Pont. "Manzate" was compared with familiar commercial fungicide programs in carefully observed and measured trials. Recommended for potatoes principally as a control for early and late blight, "Manzate" was first recognized about a decade ago for control of the major fungus diseases of tomatoes. It has also consistently rated high as a fungicide for potatoes in tests in northeastern and midwestern potato areas. It came into regular full-scale use in Maine last year, and was used on large acreages on Long Island as the all-season potato fungicide. Where comparisons were available, 80 per cent of the growers interviewed reported that areas sprayed with "Manzate" produced more than those treated with standard materials. Growers often reported that fields were free of blight, even when surrounded by severely infested fields.

* *Du Pont trademark.*

Hall of Fame Honors Farmers

The advance of civilization, as measured by the progress of agriculture, is being commemorated in the Agricultural Hall of Fame now taking shape on 409 acres near Kansas City. The project is developing under the leadership of representatives of many different U.S. groups concerned with agriculture.

Indicative of the people who are joining this effort to honor the American farmer and his colleague throughout the world is the board of 91 governors, representing farm organizations, education and agricultural extension, business and industry, farm communications, state commissioners of agriculture, government officials, cooperatives, banking, religious groups, and foundations. An executive committee conducts the day-to-day business. The executive director, Dr. A. Webster Tenney, was for 14 years national executive secretary of the F.F.A.

The project will center around a main building in which the immortals of agriculture will be honored. Corridors will radiate from its 90-foot dome like the spokes of a wagon wheel. It will also house the auditorium, meeting rooms, and cafeteria. There will also be a museum of the history of farming, library, outdoor amphitheater, field demonstration areas, and an international shrine. One time U.S. rural life will be shown in the reproduction of an early village and original American farming will be shown in an Indian village.

The building program will begin in 1960 with the Hall of Fame itself, and will progress as funds become available. Giant machines rolled onto the tract last July to move the first 100,000 cubic yards of dirt. On September 6, 1959, some 2,500 county agricultural agents met there to dedicate a flagpole in honor of "America's first county agent": Squanto, the Indian who befriended the Pilgrims at Plymouth in 1620. Farm leaders and government officials from 25 foreign countries will meet September 16 to dedicate an international shrine. Soil from farms all over the world will be deposited to signify the common bond among farmers.

Kansas and Missouri farmers and farm leaders are backing the project with local efforts of their own. One of these is the Kansas "Bushels of Grain for the Agricultural Hall of Fame." Participants will authorize elevator operators to deduct money for the Hall of Fame from their payments.

In one exhibit section, the advancement of American agriculture from the predominant occupation of the people to an occupation of only 12 per cent of the population will be portrayed. This exhibit will show how in the past 30 years, for example, the average farmer's production has increased 160 per cent, compared to the industrial worker's 120 per cent.

Mobile displays, films, and dioramas will combine entertainment with instruction, especially for children and students. There will be a variety of typical American farms in miniature with moving grazing animals, tractors, and threshing machines. Displays will show the progress of products from farm to table, and illustrate trends, production, and investment.

The central building is estimated to cost $3,250,000. Costs for the early American village, the Indian village, the outdoor amphitheater, and grading and landscaping have been set at $1,000,000. The balance of the initial development fund will be used to furnish and equip the buildings and finance initial operations. Thereafter, operating and maintenance expense are to come from admission fees and grants. Industries allied with farming are studying the possibilities of erecting buildings.

Since all development and construction costs are to be financed by private contributions, not government funds, a $5,000,000 fund raising campaign is now under way. Early returns indicate that half of the goal will be raised in Kansas and adjoining states. The national drive is being directed by a national advisory committee on fund raising. Raymond C. Firestone, President of the Firestone Tire and Rubber Company, is chairman. The Vice-chairman is Clark W. Davis, General Manager of the Du Pont Industrial and Biochemicals Department. Both men are also on the Board.

By J. P. LINDUSKA, Ph.D.
Director of Wildlife Management
Remington Arms Company, Inc.

The landowner with an eye to the future will nurture his woodlands. The outlook is for increased need for wood products, and not all merchantable timber is produced in forests. Small woodland tracts contribute substantially, and they offer multiple values when properly handled.

The most common mistake in farm woodlands is grazing. Little is gained in pasture and much is lost in tree reproduction and use by wildlife. Practically all farmers will be ahead economically if they fence their woodlots and manage such areas for a future wood crop. If loafing shade is needed for cattle, a small portion can be left outside the fence.

Woodlot management and game management go hand in hand. A protected wood has the understory of shrubs, vines, and young trees that provide homes for "critters" of sporting interest. The cottontail is a common resident of ungrazed woodlands, as are pheasants and quail. The coppice growth of protected woodlots provides good cover for these game birds, as well as yielding berries and fruits. Some birds are largely confined to a shrub-type environment, and a woods will have 10 times the number and variety of a unit trampled by cows.

Tree squirrels are, of course, tied to woodland habitat. In most areas, they will build leaf nests for makeshift shelter. But in rough weather and for rearing their young, tree hollows make for better survival. Leaving one or two dead trees per acre is good squirrel management. And even if it is a minor departure from intensive forest management, the pay-off, come autumn, makes it worthwhile.

Where a farm woodlot does not exist, it can be created. Slopes that are inclined to wash with pasturing are best converted to woodland. A managed timber stand is a good bet for most farms. It is a way of disposing effectively of problems on steep, gully-susceptible land. It adds variety to an otherwise monotonous landscape, and offers a place of relaxation and sport. And over the long pull, it will represent a source of income which took little or no effort to produce.

PLEASANT DAYS afield resulting from proper farm woodlot management. This Maryland farm boy displays his take of Bryant's fox squirrels, America's largest tree squirrel, on his family's farm.

ELIMINATING SPOILAGE WITH TRENCH SILO COVERS

Careful use of lightweight plastic covered with sawdust or some similar material can almost completely eliminate the top spoilage from a trench silo. The plastic can be reused a second year with reasonable care, greatly reducing the cost of the cover. The $214 savings in silage above the cost of the plastic on a silo 20 by 100 feet is a very high return for the amount of labor required.—AGRICULTURAL EXPERIMENT STATION, MISSISSIPPI STATE COLLEGE.

AIR CONDITIONING DAIRY SHELTERS

Air conditioned shelters may be profitable if the average daily temperature and relative humidity are excessive 60 or more days each year. This finding should serve as a guide to dairymen considering the advisability of air conditioning barns. For a well-insulated, 100-cow, stall-type dairy barn, air conditioning could prevent 10 per cent decline in milk production on days when outside temperature is 80 degrees and relative humidity higher than 75 per cent.—U. S. DEPARTMENT OF AGRICULTURE.

Supplementation of Rice with Lysine and Threonine

By HANS R. ROSENBERG, R. CULIK, and R. E. ECKERT*
Stine Laboratory
E. I. du Pont de Nemours and Co., Inc.

It has long been known that the quality of a protein depends on the balance of essential amino acids it contains. Eight amino acids, in proper balance with each other, are essential to proper growth of the animal body. If one of these is inadequate, the resulting imbalance has a depressing effect on growth, even though there may be a sufficiency or even surplus of any of the other seven.

This concept has been useful in the improvement of protein quality in both human and animal feed by the addition of the first limiting amino acid which, in the case of most grains, is lysine. A previous study† on rice diets showed that lysine supplementation as low as 0.1 per cent of the total diet allowed rats to reach maximum attainable weight gain.

The purpose of the present study was to discover the effect of supplementation of rice with the second limiting amino acid, threonine. The working hypothesis was postulated that further improvement in weight gain could be obtained by simultaneous addition of lysine and threonine, in proportion to the animal's requirement, until a balance is reached with the third limiting amino acid. This theory was confirmed experimentally.

More than a dozen separate experiments, each of five weeks' duration, were performed, involving 14 different levels of lysine in various combinations with seven different levels of threonine in the diet of nearly 1,000 rats.

Maximum rate of gain was found at a ratio of lysine to threonine of 1.4 to 1, with lysine supplementation at 0.34 per cent of the diet, and threonine at 0.18 per cent. Optimum efficiency of food utilization occurred at slightly higher levels.

The evidence of these experiments indicates that multiple amino acid supplementation of a protein should be carried out in such a manner that, according to the needs of the organism, the amino acids are present in the proper ratio to each other and in nutritional balance to the successively limiting amino acids. These experiments also demonstrate that for the rat threonine, rather than histidine, is the second limiting amino acid in rice.

* *Excerpts from a paper delivered before the American Institute of Nutrition, Atlantic City, N. J., April 12-17, 1959, and accepted for publication in the* Journal of Nutrition.

† *Agricultural News Letter, Vol. 26, No. 3, Summer 1958, page 12.*

Protection of Nursery Stock from Rodents

Several tests made since Du Pont introduced "Arasan" 42-S, the first liquid suspension of thiram, last year provide conclusive evidence of its effectiveness as a repellent for rodents, deer, and other animals that damage fruit trees and nursery stock. Additional trials are underway to determine with greater precision methods of application for various types of trees and animals, and other refinements of technique which can come only from field experience.

"Arasan" 42-S is a stable suspension of very fine particles of thiram. There are four pounds of active chemical to each gallon of suspension. The product has a natural adhesive property which reduces greatly the need for a supplemental "sticking" agent when used undiluted. Since the particle size is very small and smooth, application through common types of spray nozzles is readily obtained.

In tests made in Delaware, brush applications of undiluted thiram suspension to which 1.5 ounce of "Rhoplex" AC-33 per gallon of "Arasan" had been added to improve adhesion, protected apple stems against rabbit damage all winter. Dormant sprays to apple orchards in Virginia and Massachusetts have eliminated deer nibbling. Two gallons of "Arasan" 42-S plus four quarts of "Rhoplex," sprayed on apple trees in December prevented winter damage from animals. Twigs were sprayed to head height.

A particularly promising field for application of thiram as a repellent is on nursery stock. Because of potential rabbit damage, nursery stock is often dug up in the fall and placed in storage until it is ready for sale in the spring. A substantial cost factor would be eliminated if the stock could simply be "stored" in the field where it is being grown. Tests made so far indicate that adequate rabbit protection is provided by thiram spraying. The final stages of developmental trial are now being analyzed to permit specific recommendations to be made and incorporated in the label directions of "Arasan" 42-S thiram fungicide.

Another use for repellent will be around many homes, especially those in the suburbs. Thiram application will protect rose bushes, pyracantha, small fruit trees, and other plant life from rabbits.

Farmers Ask About . . . .

Q: How serious is the effect of keeping time on the hatchability of turkey eggs?

A: A Virginia Station report states that eggs lose eight percent of hatchability the second week.

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Q: How does the grape berry moth overwinter?

A: The pupa overwinters on the surface of the soil underneath the vines, rolled up in a leaf.

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Q: What is the outlook for future farm production?

A: In ten years, there may be a one-sixth gain in population and, if better diet trends continue, farm output may have to be 25 per cent higher.

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Q: Is it true Du Pont has more stockholders than employees?

A: Yes, over 213,000 stockholders and 83,000 employees.

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Q: Who invented the gunshot stunner used in slaughter of cattle?

A: Remington Arms Company, a Du Pont subsidiary.

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Q: What effect does latent ring spot virus have on cherry yield?

A: A study at Cornell showed yield of Montmorency cherries was about 20 per cent less for infected than healthy trees.

* * * * *

Q: What are the symptoms of calcium deficiency in cotton seedlings?

A: Symptoms range from collapse and death of the hypocotyl, to chlorosis and necrosis of the cotyledonary leaves and stunting of the young plants, a syndrome similar to that caused by soil-borne fungi.

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Q: Does mechanical injury of peanut seed reduce germination?

A: No, but stands are impaired because of slower emergence, according to a study at the Virginia Station.

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Q: When did frozen foods first come on the market?

A: Thirty years ago, but major demand did not start until World War II.

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Q: Does Fusarium root rot affect protein content of beans?

A: Beans from healthy plants have been found to contain more crude protein and as much or more of the 10 amino acids than infected ones.

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Q: What is the yield advantage of grain sorghum hybrids?

A: Some hybrids produced 20 per cent more grain than open pollinated varieties in an Arkansas study.

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Q: Are the prices of Du Pont products higher than last year?

A: No, they are down about one per cent in the past twelve months and over seven per cent below the 1953 average.

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Q: Did the apricot originate in Armenia?

A: Named "Prunus Armeniaca" because its origin was once believed to be Armenia, the apricot probably comes from western China and was brought to Europe about the time of Christ.

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Q: How can beef animals that are carriers of the dwarf gene be identified?

A: X-rays are used in early screening of animals. The x-ray is particularly useful in determining the dwarf or non-dwarf character of dead calves.

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Q: Does Du Pont do a large military munitions business?

A: No, the average over the past five years has been under one-tenth of one per cent of sales, and this was mostly in small batches of experimental smokeless powders.

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Q: How can wild fish be controlled in farm reservoirs?

A: When bass are stocked in adequate numbers, they will "police" the pond by eating the eggs and fry of so-called "trash" fish.

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Q: What are space requirements for confinement feeding of pigs?

A. An Arkansas study report states that 16 square feet per animal proved adequate, with pigs requiring less feed per pound of gain than at either 8 or 24 square feet.

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Q: Will Du Pont continue its "Show of the Month" this season?

A: Yes, with the first production, "Body and Soul," to be presented on September 28, 8:30 to 10:00 p.m., over the CBS-TV network. In addition, Du Pont's Textile Fibers Department will launch a weekly dramatic series, with June Allyson as hostess, over CBS, at 10:30 p.m., EDT, on September 21.

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